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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT/RU 2003/000512	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No.	International filing date (<i>day/month/year</i>) 20 November 2003 (20.11.2003)	Priority date (<i>day/month/year</i>)
International Patent Classification (IPC) or national classification and IPC 7 B21D 47/00, B32B 3/28, E04C 2/34		
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1. This report is the international preliminary examination report, established by the International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
- a. ☒ (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:
- ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of the report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ Sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 18 October 2005 (18.10.2005)	Date of completion of this report 14 March 2006 (14.03.2006)
Name and mailing address of the IPEA/RU FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1 Facsimile No.	Authorized officer N. Pozhidaeva Telephone No. 240-25-91

Form PCT/IPEA/409 (cover sheet) (April 2005)

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/RU 2003/000512

Box No. I Basis of the opinion

1. With regard to the language, this report is based on:

- ☐ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed.")*:3. ☐ the international application as originally filed/furnished☒ the description:

pages _____ as originally filed/furnished

pages* 1-4 received by this Authority on 25 January 2006 (25.01.2006)

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 5 received by this Authority on 25 January 2006 (25.01.2006)

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1/2-2/2 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) see Supplemental Box Relating to Sequence Listing.3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims. Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (specify): _____
- ☐ any table(s) related to the sequence listing (specify): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims. Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (specify): _____
- ☐ any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded".

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/RU 2003/000512

Box No. V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1	YES
	Claims		NO
Inventive Step (IS)	Claims	1	YES
	Claims		NO
Industrial Applicability (IA)	Claims	1	YES
	Claims		NO

2. Citations and explanations (Rule 70.7):

The following documents cited in the search report are referred to in this report:

D1: JP 64-004254 A

D2: JP 2001-232431 A

D3: US 5635306 A

D4: AT 389070 B

Analysis of D1-D4 has revealed the following.

The document D1 represents the closest prior art, which discloses a method for the production of sandwich panels with a corrugated core, comprising the separate shaping of outer skins and the core and subsequent connection thereof, the core is obtained by means of sheet blank bending to obtain corrugations forming the core profile and by punching holes in the sheet for connecting the core with outer skins.

The claimed method differs from that disclosed in D1 in that it comprises forming the zigzag corrugated core by means of sheet blank bending along the marked-out on the core development zigzag lines, the holes are punched at the points of intersections of said zigzag lines, and the diameter of holes is not less than the maximum sheet blank bending radius.

Based on the foregoing the invention claim meets the criterion of novelty.

The shaping of the zigzag corrugated core provides the increase in the stiffness of a panel, and punching of holes of the indicated diameter at the points of intersections of the development zigzag lines makes it possible to improve the conditions of core shaping and, as a result, to increase the core-skin connection strength.

These features are not found in the documents D2-D4 and are not obvious for a skilled person in view of the achievement of the above-mentioned technical result.

Consequently, invention claim meets the criterion of inventive step.

Invention claim meets the criterion of industrial applicability.

Amended claims under Art. 34 PCT**METHOD FOR PRODUCTION OF SANDWICH PANELS
WITH ZIGZAG CORRUGATED CORE****Technical Field**

The invention can be defined in its most general form as a method for production of sandwich panels with zigzag corrugated core from sheet material used in aircraft construction, shipbuilding, and other branches of industry.

Background Art

The method for production of sandwich panels with zigzag corrugated core including separate shaping of core layer and outer skins while core is produced by means of sheet blank bending along the zigzag lines of protrusions and recesses with the use of the marking-out, is taken as a prototype (SU Inventors' certificate No. 1,830,326 A1 Method for curvilinear sandwich panel with zigzag corrugated core production, Int. Cl. B 23 K 20/00, Bulletin no. 28 of 30.07.93).

The short-coming of herein-presented method is in raise of material due to the stretching out effect in nodal zones. This effect occurs when shaping corrugated core in its nodal zones where at least four ridges of folded structure converge and a simultaneous bending in two planes takes place. It results in panel strength deterioration due to the point contact between the core and the skins since they interconnect only in nodal zones rather than along the lines of protrusions and recesses. In addition, the conditions of blank material deformation are least favorable due to necessity of applying considerable efforts when shaping; it results in concentration of stresses at this very zones and adversely affects the core-skin connection strength.

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ИЗМЕНЕННЫЙ ЛИСТ

Disclosure of Invention

The invention has for its object to improve the conditions of core shaping owing to elimination of bending zones in two planes and to increase the core-skin connection strength.

The technical result attained by our invention is the improvement of panels with folded structure core production quality.

The herein-presented technical result is attained by that in the known method for production of sandwich panel with zigzag corrugated core including separate shaping of the outer skins and the core and their further connection while the prescribed crimp profile is obtained by sheet blank bending along the marked-out on the development zigzag lines, – according to the technical solution: in the sheet blank of zigzag corrugated core development at the points of bending lines intersections the holes are punched with the diameter equal to $d_h \geq R_b$, where R_b is the maximum sheet blank bending radius.

The undertaken by the applicant state of the art analysis shows that there are no analogs characterized by the combination of the features identical to those of the invention. Therefore, the claimed technical solution satisfies the “novelty” condition of patentability.

The results of retrieval for the known solutions in the given area with the aim to reveal the features identical with distinctions of the claimed technical solution show that its features do not result from the state of the art. From the defined state of the art the applicant managed to reveal no influence of the specified essential features upon the attainment of the stated technical result. The claimed technology, therefore, satisfies the “inventive step” condition of patentability.

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Brief Description of Drawings

The figures 1-4 present the essence of the invention:

Fig. 1 is a general view of panel with zigzag core (the upper skin is not shown);
Fig. 2 shows a flat blank of core with the holes at the points of crimp zigzag line
5 protrusions and recesses; Fig. 3 is a sectional view A-A of Fig. 1; Fig. 4 is a
scaled up view I of Fig. 1 sectional view A-A.

The figures 1-4 present the following positions:

1 is the lower and the upper (not shown) skins; 2 is the corrugated core; 3 are the
zigzag lines of crimp protrusions; 4 are the zigzag lines of crimp recesses; 5 are
10 the saw-tooth lines; 6 is the core sheet blank; 7 are the holes at locations of zigzag
and saw-tooth lines; 8 is the composite material with adhesive properties.

Best Mode for Carrying Out the Invention

The claimed method can be realized in the following way:

- 15 1) the outer and the inner skins 1 of the panel are produced;
- 2) the bending lines 3, 4, and 5 are marked-out on sheet blank 6 having the
dimensions of the core 2 in its plane state; the parameters and relative position
of bending lines 3, 4, and 5 are related by ready-made core 2 design
parameters:

$$20 \quad L_d = f(H, L); \quad V_d = f(V, L_d); \quad S_d = f(V, S, H, L), \text{ wherein}$$

H is the height of zigzag crimp, V is the amplitude of zigzag lines, $2S$ is the
step between zigzag lines, $2L$ is the step between saw-tooth lines of the core,
 $2S_d$ is the step between zigzag lines, L_d is the distance between zigzag lines, V_d
is the amplitude of zigzag lines on the core development;

- 25 3) the holes 7 are punched in the blank at the points of intersections of saw-tooth
5 and zigzag 3 and 4 lines; the diameter of the holes 7 is equal to $d_h \geq R_b$,
where R_b is the sheet blank bending radius at the points of intersections of
saw-tooth 5 and zigzag 3 and 4 lines in the ready-made core 2;
- 4) the sheet blank 6 is shaped until the 3-D relief core structure 2 is formed;

- 5) the obtained folded structure 2 is connected with the outer and inner skins 1, e.g. with the use of composite material 8 with adhesive properties.

Industrial Applicability

5 The claimed method for production of sandwich panels with zigzag corrugated core can be used in industrial production of aircraft sandwich panels. Created on the basis of the claimed method equipment will allow to improve the zigzag corrugated core production quality and increase the sandwich panel strength.

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Amended claims under Art. 34 PCT

Claim

- 5 The method for production of sandwich panels with zigzag corrugated core including separate shaping of the outer skins and the core whose crimps are of given profile and their further connection while given crimp profile of the core is obtained by means of sheet blank bending along the marked-out on the core development zigzag lines is characterized by that in the sheet blank of the core at
- 10 the points of intersections of said zigzag lines the holes are punched whose diameter is not less than the maximum sheet blank bending radius.

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